

NASA Environmentally Responsible Aviation Project

N+2 Advanced Vehicle Concepts NASA Research Announcement (NRA) Draft Solicitation

Draft Solicitation Posting in preparation for February 11, 2010 Pre-Proposal Meeting: The National Aeronautics and Space Administration (NASA), Aeronautics Research Mission Directorate's (ARMD) Environmentally Responsible Aviation (ERA) Project under the Integrated Systems Research Program (ISRP) is hosting a NASA Research Announcement (NRA) Pre-Proposal Meeting in Washington D.C. to share information and to seek input on the draft version of the N+2 Advanced Vehicle Concepts NRA Solicitation presented below.

1. Project Overview

NASA's Environmentally Responsible Aviation Project (ERA) is the first and, currently, only project under the new Integrated Systems Research Program (ISRP), which started under NASA's Aeronautics Research Mission Directorate (ARMD) in FY 2010. The goal of ISRP is to serve as a technology transition bridge between the lower TRL efforts on-going in the fundamental ARMD Programs and higher TRL needs of potential users. NASA's Environmentally Responsible Aviation (ERA) Project will conduct research into technologies and integrated aircraft systems that will allow transport aircraft to simultaneously reduce noise, emissions and fuel burn in the 2025 (or beyond) time frame. NASA subsonic transport system level metrics/goals for ERA are shown in Table 1. As highlighted in the middle column of this table, the ERA Project is focused on the fuel burn (a surrogate for CO₂), LTO NO_x and noise goals. Furthermore, ERA will focus energy and resources on maturing certain very promising technologies to TRL 6 over the next five years.

CORNERS OF THE TRADE SPACE	N+1 = 2015*** Technology Benefits Relative To a Single Aisle Reference Configuration	N+2 = 2020*** Technology Benefits Relative To a Large Twin Aisle Reference Configuration	N+3 = 2025*** Technology Benefits
Noise (cum below Stage 4)	-32 dB	-42 dB	-71 dB
LTO NO _x Emissions (below CAEP 6)	-60%	-75%	better than -75%
Performance: Aircraft Fuel Burn	-33%**	-50%**	better than -70%
Performance: Field Length	-33%	-50%	exploit metro-plex* concepts

***Technology Readiness Level for key technologies = 4-6

** RECENTLY UPDATED. Additional gains may be possible through operational improvements

* Concepts that enable optimal use of runways at multiple airports within the metropolitan area

Table 1 – NASA's Technology Goals for Future Subsonic Vehicles

The projected growth of the air transportation system over the next 20 years will increase emissions of greenhouse gases, such as carbon dioxide (CO₂), nitrogen oxides (NO_x), water

vapor, and particulates, and the number of people exposed to airport noise. It is also widely believed that environmental and energy concerns will continue to grow as well, leading to increasingly stringent certification levels for noise and emissions, and an unending requirement for vehicle fuel efficiency improvements. All this must be achieved without adversely affecting the outstanding record of the global aeronautics enterprise for safety, reliability, and security. It is for these reasons that the ERA project chose the simultaneous reduction of noise, emissions and fuel burn as the focus. The proposed vehicle concept(s) must efficiently operate within the NextGen airspace system that is currently being developed. Results of this study are meant to be complementary to other ongoing U. S. Government led programs listed in Table 2.

Agency	Project or Activity	Funded Years	Vehicle Focus	Proposed TRL	Goal: Major Reduction/ Minor Reduction
FAA	CLEEN	FY10-FY14	N+1	6-7	Noise Emissions Fuel burn
DoD	ADVENT/ HEETE/ AD- HEETE	FY10-FY14	N+2	>6	Fuel burn <i>Noise</i> <i>Emissions</i>
NASA	ERA	FY10-FY14	N+2	4-6	<u>Simultaneous</u> Noise Emissions Fuel Burn
NASA	SFW & SUP	FY10-FY14	N+3	2-4	Noise Emissions Fuel Burn
DoD	RCEE	FY10-FY14	Beyond N+3	2-6	Fuel Burn <i>Emissions</i> <i>Noise</i>

Table 2 - Complementary Government Research Programs

The NASA ERA Project has been organized into two distinct phases as seen in figure 1 below. Phase I began in FY2010, and will run until the end of FY 2012. Phase I has approximately

thirty research efforts divided into three groups, each with a project engineer responsible for guiding those efforts. Many of the current research projects transitioned from NASA's Subsonic Fixed Wing project and are technologies believed ready to advance to TRL 6. The three ERA sub-projects are: 1) Airframe Technology, which includes research into Lightweight Structures, Flight Dynamics and Control, Drag Reduction, and Noise Reduction; 2) Propulsion Technology, which includes research into Combustors, Propulsor concepts, and the Core; and 3) Vehicle Systems Integration, which includes research in Systems Analysis, Propulsion Airframe Integration, Propulsion Airframe Aeroacoustics, and Advanced Vehicle Concepts. Some additional information on the ERA Project can be found on the ISRP website (http://www.aeronautics.nasa.gov/programs_isrp.htm).

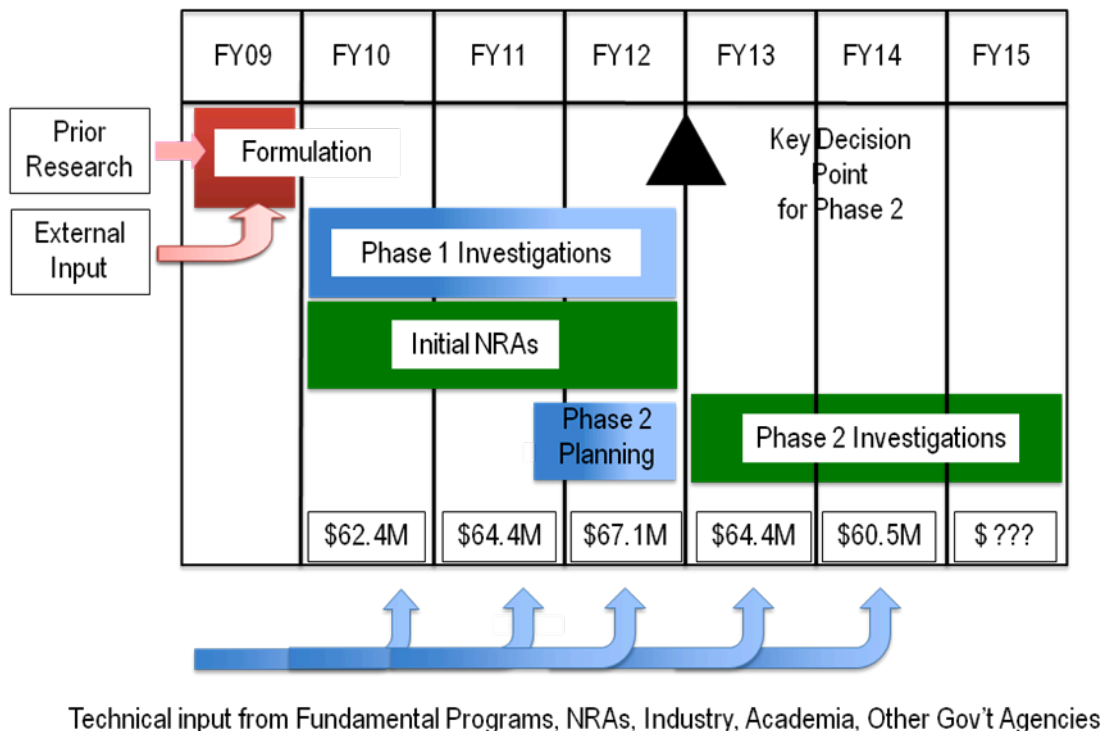


Figure 1. ERA project flow and annual budget

Phase II, which is planned to begin in FY 2013 and run for the remainder of the ERA project (currently FY 2014), will be focused on a relatively small number of key technology demonstrations (perhaps 3 to 5) that either show significant promise towards meeting the ERA project goals or perhaps represent technologies and integrations that 'enable' the most promising preferred system concepts. These could be extensions of the ERA Phase I work, new technologies, or new system integration work. This solicitation and subsequent studies are expected to provide a menu of potential ERA Phase II investigations for NASA consideration.

Approximately \$9M is available for two or three different awards under this solicitation. The expected duration of each award is 18 months.

2. Description of Solicited Research

2.1 Objective

This solicitation is intended to identify advanced integrated vehicle and component technology concepts that will allow transport aircraft to simultaneously meet the NASA subsonic transport system level goals of reduced noise, emissions and fuel burn in the 2025 (or beyond) time frame. These research vehicle concepts must operate efficiently within the NextGen airspace system that is currently being developed. It is believed that to achieve required aircraft system readiness level in this time frame, all critical technologies that could be considered ‘enabling technology’ need to be at a TRL level of 6 by 2020. The results of this study are meant to be complementary to a number of on-going and planned government programs such as the FAA’s CLEEN program, NASA’s Subsonic Fixed Wing Project, and a number of Department of Defense programs as identified in Table 2.

Highly integrated propulsion/airframe concepts or other significant configuration changes (vs. today’s tube-and-wing) will be required to simultaneously meet ERA’s noise, emission and fuel burn goals. Preferred System Concepts (PSC) for both the cargo and passenger aircraft concepts will be required. The passenger vehicle mission should be capable of an 8,000 nm range with a 50,000-pound payload, and the cargo/freighter mission will have a 6500nm range with a 100,000-pound payload. Cruise Mach number shall be 0.85. These range and payload requirements were chosen to focus the research toward long haul vehicle classes. In addition, the sensitivity of these concepts to both increases and decreases in the range, payload, or Mach number requirements are desired such that the limits of the extensibility to other missions can be defined.

A significant objective of this study is to develop technology maturation plans that outline the research required to develop the technologies and integrated aircraft systems critical to simultaneously meeting the noise, emission and fuel burn goals. A requirement is the development of a 15-year time phased technology maturation plan that would enable the envisioned aircraft system concept(s) to enter service (market permitting) by 2025. Starting and ending technology and system readiness levels must be identified as part of the technology maturation plan. Contractor specific definitions of these terms (TRL and SRL) shall be provided. Another very important aspect of the technology maturation plan is an understanding and prioritization of those critical technology demonstrations that must be performed in the FY 2013-2015 time frame. These key technology demonstrations may be regarded as those that ‘enable’ the PSC and/or represent those critical technologies that must be addressed initially. It is the goal of ERA to mature these identified critical technologies to TRL 6 in the 2013-2015 timeframe.

2.1.1 Integration into NextGen – NextGen is the Next Generation Air Transportation System, and refers to a wide-ranging initiative to transform the air traffic control system so that it can maintain or improve safety while increasing its capacity and reducing delays. It focuses on leveraging new technologies, such as satellite-based navigation, surveillance, and networking,

however new airframe technologies such as wake vortex alleviation technologies to permit closer spacing may also contribute to the transformation. The initiative involves meaningful collaboration among government departments and agencies as well as companies in the aerospace and related industries. A critical element of this study will be an analysis of how the PSC will integrate into NextGen. In order to accomplish this analysis the following three steps must be completed:

1. Based on JPDO and NextGen documentation (see <http://www.jpdo.gov/library.asp>) define what NextGen will be in 2025 for both enroute mission segments and terminal area segments. This will require making assumptions regarding the technology and resource levels available and successfully applied between now and 2025. This assumed NextGen environment is required to assess the integration of the PSC.
2. Utilizing the projected NextGen environment from the previous step, analyze the integration of the PSC into this operational environment. How will both the terminal area and en route operations change under the projected 2025 environment? How will the PSC, when integrated into the fleet, affect noise contours and LTO NO_x and particulate and carbon emissions at a given airport where long-range transports are prominently used?
3. Identify any key requirements that should be provided to NASA's Airspace Program and to JPDO to enable optimal integration of the PSC into the NextGen environment.

This element should not be more than 10% of the total effort.

2.1.2 Noise – The ultimate national goal for noise reduction is to contain objectionable noise within airport boundaries. The Environmental Protection Agency established in 1973 that, to protect health and welfare with an adequate margin of safety, outdoor noise exposure should be no more than 55 dB Day Night Level (DNL). The N+3 noise goal of -71 dB cumulative below stage 4 noise certification standards is related to achieving this ultimate noise reduction goal at the aircraft level. The N+2 metric of -42 dB cum below stage 4 represents an aggressive, but feasible interim milestone on the path towards achieving the N+3 goal that, when fully implemented for all aircraft, has the potential to contain the 65 dB DNL noise contour for most U.S. airports within the compatible land use areas. It is anticipated that this goal will require technology improvements like innovative shielding, but can also include new flight procedures such as Optimized Profile Descents (OPDs), which include such operations as Continuous Descending Approaches and steeper glide path angles.

2.1.3 Emissions – The primary emissions goal is to reduce LTO (Landing/Take-Off) NO_x by 75% relative to CAEP 6 standards. While LTO NO_x is currently emphasized, NASA recognizes that the emphasis on other emissions related to local and global environmental and health issues may become equal to, or greater than, LTO NO_x in the future. As such, the study shall also identify technologies to reduce cruise NO_x and CO₂, mitigate global warming effects of water vapor; and reduce aerosols and solid particulates that contribute to the formation of aircraft induced cirrus cloud formation and reduce the emission of PM 2.5. It is expected that other vehicle classes will benefit from the technologies developed for the focused N+2 vehicle concept. It should be recognized that the ERA Project has an existing NRA solicitation specifically targeting combustor technology and reductions in LTO NO_x through efficient combustor design. This NRA should be complementary to the Combustor NRA, not duplicative.

2.1.4 Performance (Fuel Burn) – To minimize aircraft operating costs and environmental impact, it is necessary that anticipated near-term trends in improved energy efficiency be continued into the 2025 timeframe and considered for this study. Toward this end, a goal of reducing fuel burn by at least 50% over a 1998 EIS reference vehicle has been set for this study. It is anticipated that this ambitious goal will be met through a combination of airframe, engine, and integrated vehicle efficiency improvements, including the use of unconventional airframe configurations, alternative engine cycles, and alternative fuels. If an alternative fuel is used in the design, multidisciplinary differences in fuel characteristics (e.g. energy density, and therefore fuel tank volume) must be considered. Also, for the purpose of this research, the energy used does not include the energy required to manufacture, refine, transport, or store the fuel prior to being loaded onto the aircraft.

2.1.5 Performance (Field Length) – Proposers may choose to address the runway length for the N+2 timeframe. However, runway length is not a primary concern for the ERA project. This could be important for certain concepts of operation in the NextGen airspace system where additional gains in fuel burn performance may be possible through operational improvements in landing and terminal area performance which may contribute to overall reduction in delays and increase in throughput.

2.1.6 Mission – Two variants of the PSC shall be designed; a passenger and cargo version. The passenger version shall be capable of carrying 50,000 lb of payload (224 passengers in three-class seating and their baggage) on an 8,000 nm range mission with a cruise Mach number of 0.85. The cargo version shall be capable of carrying 100,000 lb of payload on a 6,500 nm range mission with a cruise M = 0.85. Figure 2 shows the mission profile ground rules that shall be utilized in this study.

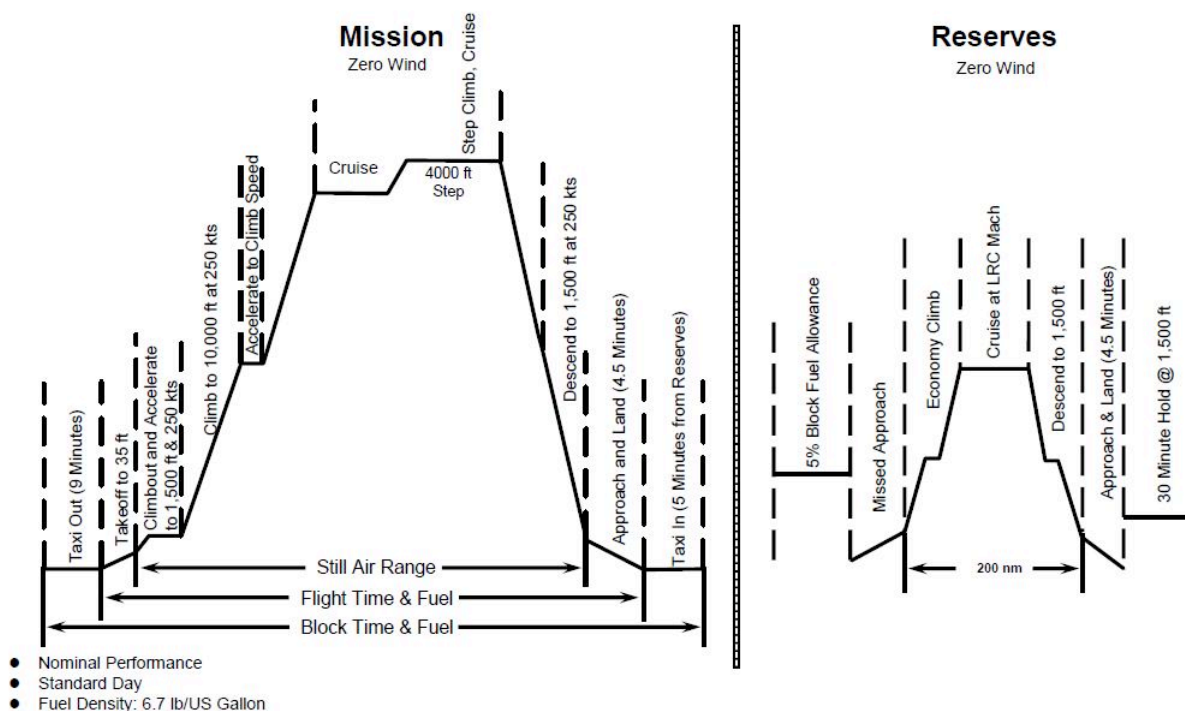


Figure 2: Mission profile for PSC design and sizing

2.1.7 Relationship to other Government Programs. The research conducted under this task should be complementary to a number of ongoing and planned government research efforts shown in Table 2 above. This study is intended to be a focused research effort leading to multiple integrated research experiments at the TRL level of 6.

2.1.8 Key Tasks

The study is required to establish credibility, and provide traceability for the PSC benefits. Therefore, the system study shall include, at a minimum, passenger and cargo versions of the following:

- 1998 EIS conventional configuration reference vehicle
- 2025 EIS conventional configuration vehicle
- 2025 EIS advanced configuration vehicle, termed the Preferred System Concept (PSC)

The 1998 EIS reference vehicles serve to calibrate capabilities and establish the credibility of the results. The 2025 EIS conventional configuration and advanced configuration vehicles establish how much of the improvement toward the goals stated in Table 1 are attributable to the use of advanced technologies, and how much is attributable to the vehicle configuration. The 2025 EIS vehicles shall be designed to the current mission profile ground rules shown in **Figure 2**, and will also be designed for the projected NextGen airspace system in order to obtain an incremental estimate for operationally derived performance benefits.

The studies shall produce:

1. A credible projected future scenario within which to describe the challenges that may be facing commercial aircraft operators in the 2025 and beyond timeframe in the NextGen airspace system. This scenario establishes a context within which the passenger and cargo Preferred System Concepts (PSCs) may meet a market need and enter into service.
2. At least two Preferred System Concepts (PSC) (one passenger vehicle and one cargo vehicle) whose mission capabilities meet or exceed the mission requirements noted above, while simultaneously meeting the NASA subsonic transport system level goals.
 - Concept data packages for the 1998 EIS reference vehicle, the 2025 EIS baseline vehicle and the PSC that include at a minimum:
 - Mission requirements, including range, payload, cruise Mach No., and take-off (balanced field length) and landing distances
 - Configuration geometry/dimensions, three-view, internal arrangement drawing, structural layout, and key sizing constraints
 - Low speed (first and second segment climb, enroute climb, approach and landing) and cruise drag polars
 - Short group weight statement and c.g. diagram
 - Mission performance parameters including total fuel burn and fuel burn per mission segment, cruise altitude, cruise L/D, noise certification numbers, and emissions.

- Propulsion system total weight/overall dimensions (length, max diameter), including a detailed weight breakdown by component. List of the projected materials envisioned, by component.
 - Propulsion performance data at key flight conditions (e.g., sea-level static, rolling takeoff, enroute climb, top-of-climb, cruise). Include engine level parameters - net thrust, ram drag, and SFC. Component level parameters such as component mass flow, total pressure ratio, total temperature ratio, appropriate efficiency parameter, and cooling requirements, as applicable, at each key flight condition. APU and other auxiliary systems are included in this, especially if they augment the aerodynamics.
 - Operational considerations for existing, real airports and TRACON airspaces, and proposed airport layouts and airspaces modified to meet NextGen goals. Consideration needs to be given for; mixed speed operations, differing glide path approaches, and variations in rate of climb with existing older aircraft in the same airspace. Impacts or improvements to delay and capacity as a result of using new vehicle technology should be addressed.
 - Design space trade studies as needed to address the future challenges and N+2 system level goals
3. Technology maturation plans (TMPs) that outline the research required to develop the technologies and integrated aircraft systems critical to simultaneously meeting the noise, emission and fuel burn goals for the PSC's defined above. A requirement is the development of a 15-year time phased technology maturation plan that would enable the envisioned aircraft system concept(s) by 2025. Starting and ending technology readiness level (TRL) and system readiness level (SRL) must be identified as part of the technology maturation plan. Contractor specific definitions of these terms (TRL and SRL) shall be provided. Key research, analyses, tool and method development, and necessary ground and flight tests required to mature the technology or successfully address the technical challenge in time to support the EIS date are desired. The PSC roadmaps should define credible intermediate performance objectives (go/no go criteria) associated with critical tests and demonstrations. The estimated cost, schedule and expected technical outcome for each major element of the roadmap should be clearly detailed. While these TMPs will go well beyond the timeframe of the current ERA Project, this information should be detailed enough to support the advocacy of possible follow-on ISRP (or other NASA Program) projects as required.
 4. Develop a prioritized list of suggested time critical technology demonstrations that must be performed in the FY 2013-2015 time frame. These key technology demonstrations may be regarded as those that 'enable' the preferred vehicle concepts and/or represent those critical technologies that must be addressed initially within ERA Phase II. For each critical technology, the roadmap should provide costs, a detailed technology maturation plan with key research, analyses, tool and method development, and necessary ground and flight tests required, background information to set the context, current status including TRL level, a risk assessment and the technology's applicability across the vehicle classes (i.e., sensitivity information - how does the technology scale beyond the PSC?). These sensitivity studies will identify a technology's contribution towards achieving the ERA goal of simultaneously meeting the N+2 noise, fuel burn and emission metrics. Important collaborative research opportunities should be highlighted where they exist. The key technologies and technical challenges will be identified for each of the four major sub-groups:

- Propulsion only - the technology or technical challenge exists primarily within the propulsion system and can be addressed at the propulsion system component level. Example: test low NO_x combustor system within existing engine testbed.
- Airframe only - the technology or technical challenge exists primarily within the airframe and can be addressed at the airframe component level. Example: Apply riblets to existing airframe for viscous drag reduction.
- Integrated Propulsion and Airframe – the technology or technical challenge can only be adequately addressed through integrated propulsion airframe analysis and testing. Example: Bifurcated engine in wing installation for ultra high bypass ratio engine.
- Integrated Vehicle Testbed – the technology or technical challenge requires analysis and testing of a fully integrated testbed vehicle (i.e., X-plane or Y-plane).

Given the need for the ERA project to retain flexibility for program planning and execution, each roadmap should contain a matrix or menu of options starting with the ideal plan as identified in Task #4 and showing trade-offs between scale, complexity, schedule, cost and risk for each major element. Alternate test techniques, ranges, test assets and risk levels should be assessed and presented for each of the key technical challenges. As an example, the Integrated Vehicle Testbed matrix should provide a range of options based on varying the scale of the testbed resulting in a trade between cost, schedule, and technical viability.

When combined, the four major sub-group roadmaps should form a coherent and comprehensive PSC Technology Maturation Plan (TMP). The TMP will be utilized to help guide future ERA (and other NASA aeronautics) investment decisions, and should therefore contain cost, performance and schedule estimates of sufficient quality to support detailed program planning.

5. The NextGen scenarios/assumptions, preferred system concepts, TMPs for both the passenger and cargo vehicle, and key near-term critical technology demonstration plans shall be thoroughly documented in progress reports, periodic technical reviews, and in a final report as noted in the deliverables section below.

2.3 Relevant ERA Milestone

In FY 2012, the ERA project has a decision point that will determine what tasks, tests, and technologies it will choose perform and to focus on in Phase II. The results of these studies will play a major role in informing those decisions.

2.4 Deliverables

The studies shall produce:

- Short monthly progress reports
- Presentation slides for interim contract progress reviews at 3 month intervals
- A final report that details the specific results of the key tasks outlined above. This document will be suitable for publication as a NASA CR (Contractor Report) and delivered 18 months into the contract period of performance.

3. Programmatic Considerations

The Environmentally Responsible Aviation project anticipates that approximately \$9M will be invested in two or three awards. The expected period of performance is not to exceed 18 months.

The technical section of the proposal is the most important for selection. It must clearly describe:

- The background and objectives of the proposed research.
- The approaches to be considered.
- The level of effort to be employed.
- The anticipated results.
- Specific quantifiable metrics to be used to judge progress.
- A well-defined work plan.
- The contribution of the work to subsonic aeronautics technology in the United States.

The science-technical-management section must not exceed 50 pages. Supporting information such as budget, resumes, and commitment letters will not be counted toward the 50-page limit. Please refer to section IV of this solicitation, "Proposal and Submission Information", for requirements on proposal content, format, budget details, and submission procedures. Bidders should propose an appropriate level of effort (cost and duration). The estimated level of effort provided with the topic description is for general guidance.

Milestones with measurable metrics toward achieving the proposed goal must be provided. As noted above, a combination of monthly progress reports, oral presentations and a final written report suitable for publication are required. Short monthly progress reports are expected. The information in these reports will be one of the factors used to determine whether adequate progress has been made. These reports should focus on key activities and the current progress. They should be less than 10 pages in length. Quarterly oral presentations are expected; the first one will occur no later than 3 months after contract go ahead. The final oral presentation should occur prior to delivery of the final report, preferably around the 15-month mark (leaving primarily the documentation of results to accomplish). It is expected that these final oral presentations will be made as part of an open technical exchange meeting for purposes of technology transfer and knowledge dissemination. These meetings will be held at one of the NASA centers, and must be attended by at least the principal investigator for the award. Finally, the complete documentation of approach and results in the form of a written final report suitable for publication as a NASA Contractor Report is required at the end of the complete effort.

One intent of the NRA process is to foster strategic partnerships between NASA and the awarded institutions for collaborative research and development of innovative concepts, ideas, technologies and approaches. Therefore substantial interaction with NASA researchers may be anticipated while performing work under these awards. Bidders may include as part of the proposal visits of appropriate length to a NASA Center for the purpose of coordinating the proposed work with corresponding efforts by NASA researchers.

In summary, the following checklist describes the minimum information expected in the science-technical management of the proposal:

- Statement of relevance to the Environmentally Responsible Aviation specified objectives of this solicitation.
- Work Plan must include a schedule with milestones and measurable metrics; as well as the qualifications, capabilities, and experience of the lead organization and team members in transport aircraft design.

- Statement of what intellectual property is expected to be publicly available at the conclusion of the work (note that it is our intent to share knowledge developed under this solicitation, thus, any restrictions to the objective may impact the evaluation of the proposal).
- Oral presentations, interim reports, and final report. A travel budget to support these reviews should be included in the proposal.

4. Evaluation Criteria and Basis for Award

The evaluation criteria in Appendix B, part (i) and Appendix C, paragraph C.2 of the “Guidebook for Proposers Responding to a NASA Research Announcement (NRA) -2010” and the evaluation criteria in Appendix A, Section A.1 of this document are superseded by the following. Every proposal will be evaluated on its own merits and not compared with other proposals. The principal elements considered in evaluating a proposal are its relevance to NASA’s objectives, technical merit, effectiveness of the proposed work plan (including cost), and proposed team qualifications. Failure of a proposal to be highly rated in any one of the following elements is sufficient cause for the proposal to not be selected.

1. Relevance (weight 20%):

- Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to the specific objectives and goals given in the solicitation to which the proposal is submitted.
- The evaluation process will also consider the importance of the work to the primary project objectives of advancing knowledge and understanding of the fundamental principles of flight unique to subsonic flights.

2. Technical Merit (weight 35%):

- Overall scientific or technical merit of the proposal, including unique and innovative methods, approaches, or concepts.
- Evaluation will also include: credibility of technical approach, including a clear assessment of primary risks and a means to address them; proposer’s capabilities, related experience, facilities, techniques, or unique combination of these which are integral factors for achieving the proposal's objectives; and qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
- The selection process will also assess the proposal against the state-of-the-art.

3. Effectiveness of the Proposed Work Plan (weight, 20%):

- Comprehensiveness of work plan, effective use of resources, cost, management approach, and proposed schedule for meeting the objectives.
- Objectives with measurable metrics toward achieving the proposer’s goal must be provided, with a minimum of one metric per year.
- Oral presentations made as part of an open Technical Exchange Meeting for purposes of technology transfer and knowledge dissemination will be expected.
- Note: This annual oral presentation still comes out of the N+3 wording. We debated this (on 1-5-10) extensively, and as far as I can tell, never reached a decision. Thoughts and options:
 - Time based or event driven?

- Have them do a public presentation at the ERA annual meeting. Most likely count this as one of their oral reports to the project.
 - Documentation of approach and results in the form of final written technical reports is required.
 - A clear statement of what intellectual property is expected to be publicly available at the conclusion of the work is required. It is our intent to share all knowledge developed under this solicitation, thus, any restrictions to that objective will cause a lower score in this area.
 - Collaboration with NASA researchers (including joint use of facilities, sharing of materials, development of computer code modules compatible with NASA's software, and synergistic research goals) is desirable, with the objective of enhancing knowledge transfer and the long-term value of the proposed work.
4. Proposed Team Qualifications (weight 25%):
- Experience and breadth of the team that is organized to conduct the study
 - Experience of the team in transport aircraft design
 - Ability of the team to offer innovative approaches to address the commercial aviation design requirements of the future.

5. References

5.1 NASA Facilities

The following websites provide information on NASA aeronautics facilities capabilities, testing, and contact information. If NASA facilities are proposed for phase 2, the facility costs associated with testing will be covered outside of the funding for this NRA; the costs of fabricating panels, fixtures, and instrumentation required for the testing shall be incurred by the proposer and included in the proposed cost. The proposal will need to specify the test article size, requirements, facility, and approximate testing time. Specific details such as timeframe and duration will be negotiated upon selection of a proposal. A non-NASA facility may be proposed, in which case the costs must be included in the proposed cost.

NASA Center	URL
Ames Research Center, ARC	http://windtunnels.arc.nasa.gov/ http://ffc.arc.nasa.gov/ (simulations facilities)
Dryden Flight Research Center, DFRC	http://www.nasa.gov/centers/dryden/capabilities/index.html
Glenn Research Center, GRC	http://facilities.grc.nasa.gov/explore/explore_aero.html
Langley Research Center, LaRC	http://wte.larc.nasa.gov/

5.2 Other References

- NASA ERA Project Website: <http://www.aeronautics.nasa.gov/isrp/era/>
- NRA Proposers Guidebook (2009 version)
<http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2009.pdf>
- Grant and Cooperative Agreement Handbook -
http://prod.nais.nasa.gov/pub/pub_library/grcover.htm

6. Summary of Key Information

Expected program budget for new awards	\$9M
Number of new awards pending adequate proposals of merit	~ 3
Maximum duration of awards	18 months
Due date for Notice of Intent to propose (NOI)	3/15/2010
Due date for proposals	4/15/2010 (with a 3/1/2010 final solicitation posting date)
NASA objective(s) which proposals must state and demonstrate relevance to	Every proposal must address the specified subtopic objective(s) and outcome(s) in the solicitation of this NRA.
Detailed instructions for the preparation and submission of proposals	See the NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2009.
Page limit for the central Science-Technical-Management section of proposal	50 pages; see also Chapter 2 of the Guidebook for Proposers
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the Summary of Solicitation of this NRA and Chapter 3 of the NASA Guidebook for Proposers.
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov (help desk available at support@grants.gov or (800) 518-4726)
Expected award type	Contracts or Cooperative Agreements
NASA points of contact (POC)	Email questions to: fayette.s.collier@nasa.gov Written responses will be posted on the solicitation website. Project Manager: Fay Collier Chief Engineer: Mark Mangelsdorf NRA Manager: Sherri Yokum